What Is Claimed Is:

1   1.   A method for performing a minimum computation for an interval

2 operation, comprising:

3   receiving at least four floating-point numbers, including a first floating-

4 point number, a second floating-point number, a third floating-point number and a

5 fourth floating-point number; and

6   computing a minimum of the at least four floating-point numbers;

7   wherein if the at least four floating-point numbers include one or two

8 default NaN (not-a-number) values and the remaining values are not default NaN

9 values, the default NaN values are ignored in computing the minimum.

1   2.   The method of claim 1,

2   wherein the minimum is a left endpoint of a resulting interval of the

3 interval operation;

4   wherein the first floating-point number is the result of an operation

5 between the left endpoint of a first interval and the left endpoint of a second

6 interval;

7   wherein the second floating-point number is the result of the operation

8 between the left endpoint of the first interval and the right endpoint of the second

9 interval;

10   wherein the third floating-point number is the result of the operation

11 between the right endpoint of the first interval and the left endpoint of the second

12 interval; and

13   wherein the fourth floating-point number is the result of the operation

14 between the right endpoint of the first interval and the right endpoint of the second

15 interval.

1   3.   The method of claim 1, wherein computing the minimum involves

2   setting the minimum to a value representing the empty interval, if any of the at

3   least four floating-point numbers contain the value representing the empty

4   interval.

1   4.   The method of claim 3, wherein the value representing the empty

2   interval is a non-default NaN value.

1   5.   The method of claim 2, wherein computing the minimum involves

2   setting the minimum to negative infinity if the first floating-point number is a

3   default NaN value and the fourth floating-point number is the default NaN value.

1   6.   The method of claim 2, wherein computing the minimum involves

2   setting the minimum to negative infinity if the second floating-point number is a

3   default NaN value and the third floating-point number is the default NaN value.

1   7.   The method of claim 1, wherein if none of the at least four

2   floating-point numbers is a default NaN value or a value representing the empty

3   interval, computing the minimum involves selecting the minimum of the at least

4   four floating-point numbers.

1   8.   The method of claim 2, wherein the operation can include one of a

2   multiplication operation and a division operation.

1   9.   A method for performing a maximum computation for an interval

2   operation, comprising:

22

3 receiving at least four floating-point numbers, including a first floating-

4 point number, a second floating-point number, a third floating-point number and a

5 fourth floating-point number; and

6 computing a maximum of the at least four floating-point numbers;

7 wherein if the at least four floating-point numbers include one or two

8 default NaN (not-a-number) values and the remaining values are not default NaN

9 values, the default NaN values are ignored in computing the maximum.

1 10. The method of claim 9,

2 wherein the maximum is a right endpoint of a resulting interval of the

3 interval operation;

4 wherein the first floating-point number is the result of an operation

5 between the left endpoint of a first interval and the left endpoint of a second

6 interval;

7 wherein the second floating-point number is the result of the operation

8 between the left endpoint of the first interval and the right endpoint of the second

9 interval;

10 wherein the third floating-point number is the result of the operation

11 between the right endpoint of the first interval and the left endpoint of the second

12 interval; and

13 wherein the fourth floating-point number is the result of the operation

14 between the right endpoint of the first interval and the right endpoint of the second

15 interval.

1 11. The method of claim 9, wherein computing the maximum involves

2 setting the maximum to a value representing the empty interval, if any of the at

3   least four floating-point numbers contain the value representing the empty

4   interval.

1   12.   The method of claim 11, wherein the value representing the empty

2   interval is a non-default NaN value.

1   13.   The method of claim 10, wherein computing the maximum

2   involves setting the maximum to positive infinity if the first floating-point number

3   is a default NaN value and the fourth floating-point number is the default NaN

4   value.

1   14.   The method of claim 10, wherein computing the maximum

2   involves setting the maximum to positive infinity if the second floating-point

3   number is a default NaN value and the third floating-point number is the default

4   NaN value.

1   15.   The method of claim 9, wherein if none of the at least four

2   floating-point numbers is a default NaN value or a value representing the empty

3   interval, computing the maximum involves selecting the maximum of the at least

4   four floating-point numbers.

1   16.   The method of claim 10, wherein the operation can include one of

2   a multiplication operation and a division operation.

1   17.   A computer-readable storage medium storing instructions that

2   when executed by a computer cause the computer to perform a method for

24

3 performing a minimum computation for an interval operation, the method

4 comprising:

5   receiving at least four floating-point numbers, including a first floating-

6 point number, a second floating-point number, a third floating-point number and a

7 fourth floating-point number; and

8   computing a minimum of the at least four floating-point numbers;

9   wherein if the at least four floating-point numbers include one or two

10 default NaN (not-a-number) values and the remaining values are not default NaN

11 values, the default NaN values are ignored in computing the minimum.

1   18.   The computer-readable storage medium of claim 17,

2   wherein the minimum is a left endpoint of a resulting interval of the

3 interval operation;

4   wherein the first floating-point number is the result of an operation

5 between the left endpoint of a first interval and the left endpoint of a second

6 interval;

7   wherein the second floating-point number is the result of the operation

8 between the left endpoint of the first interval and the right endpoint of the second

9 interval;

10   wherein the third floating-point number is the result of the operation

11 between the right endpoint of the first interval and the left endpoint of the second

12 interval; and

13   wherein the fourth floating-point number is the result of the operation

14 between the right endpoint of the first interval and the right endpoint of the second

15 interval.

25

1   19.   The computer-readable storage medium of claim 17, wherein

2   computing the minimum involves setting the minimum to a value representing the

3   empty interval, if any of the at least four floating-point numbers contain the value

4   representing the empty interval.

1   20.   The computer-readable storage medium of claim 19, wherein the

2   value representing the empty interval is a non-default NaN value.

1   21.   The computer-readable storage medium of claim 18, wherein

2   computing the minimum involves setting the minimum to negative infinity if the

3   first floating-point number is a default NaN value and the fourth floating-point

4   number is the default NaN value.

1   22.   The computer-readable storage medium of claim 18, wherein

2   computing the minimum involves setting the minimum to negative infinity if the

3   second floating-point number is a default NaN value and the third floating-point

4   number is the default NaN value.

1   23.   The computer-readable storage medium of claim 17, wherein if

2   none of the at least four floating-point numbers is a default NaN value or a value

3   representing the empty interval, computing the minimum involves selecting the

4   minimum of the at least four floating-point numbers.

1   24.   The computer-readable storage medium of claim 18, wherein the

2   operation can include one of a multiplication operation and a division operation.

1   25.   A computer-readable storage medium storing instructions that

2 when executed by a computer cause the computer to perform a method for

3 performing a maximum computation for an interval operation, the method

4 comprising:

5   receiving at least four floating-point numbers, including a first floating-

6 point number, a second floating-point number, a third floating-point number and a

7 fourth floating-point number; and

8   computing a maximum of the at least four floating-point numbers;

9   wherein if the at least four floating-point numbers include one or two

10 default NaN (not-a-number) values and the remaining values are not default NaN

11 values, the default NaN values are ignored in computing the maximum.

1   26.   The computer-readable storage medium of claim 25,

2   wherein the maximum is a right endpoint of a resulting interval of the

3 interval operation;

4   wherein the first floating-point number is the result of an operation

5 between the left endpoint of a first interval and the left endpoint of a second

6 interval;

7   wherein the second floating-point number is the result of the operation

8 between the left endpoint of the first interval and the right endpoint of the second

9 interval;

10   wherein the third floating-point number is the result of the operation

11 between the right endpoint of the first interval and the left endpoint of the second

12 interval; and

13   wherein the fourth floating-point number is the result of the operation

14 between the right endpoint of the first interval and the right endpoint of the second

15 interval.

1   27.   The computer-readable storage medium of claim 25, wherein

2 computing the maximum involves setting the maximum to a value representing

3 the empty interval, if any of the at least four floating-point numbers contain the

4 value representing the empty interval.

1   28.   The computer-readable storage medium of claim 27, wherein the

2 value representing the empty interval is a non-default NaN value.

1   29.   The computer-readable storage medium of claim 26, wherein

2 computing the maximum involves setting the maximum to positive infinity if the

3 first floating-point number is a default NaN value and the fourth floating-point

4 number is the default NaN value.

1   30.   The computer-readable storage medium of claim 26, wherein

2 computing the maximum involves setting the maximum to positive infinity if the

3 second floating-point number is a default NaN value and the third floating-point

4 number is the default NaN value.

1   31.   The computer-readable storage medium of claim 25, wherein if

2 none of the at least four floating-point numbers is a default NaN value or a value

3 representing the empty interval, computing the maximum involves selecting the

4 maximum of the at least four floating-point numbers.

1   32.   The computer-readable storage medium of claim 26, wherein the

2 operation can include one of a multiplication operation and a division operation.

1   33.   An apparatus that performs a minimum computation for an interval

2   operation, comprising:

3   an input that is configured to receive at least four floating-point numbers,

4   including a first floating-point number, a second floating-point number, a third

5   floating-point number and a fourth floating-point number; and

6   a computing mechanism that is configured to compute a minimum of the

7   at least four floating-point numbers;

8   wherein if the at least four floating-point numbers include one or two

9   default NaN (not-a-number) values and the remaining values are not default NaN

10   values, the default NaN values are ignored in computing the minimum.

1   34.   The apparatus of claim 33,

2   wherein the minimum is a left endpoint of a resulting interval of the

3   interval operation;

4   wherein the first floating-point number is the result of an operation

5   between the left endpoint of a first interval and the left endpoint of a second

6   interval;

7   wherein the second floating-point number is the result of the operation

8   between the left endpoint of the first interval and the right endpoint of the second

9   interval;

10   wherein the third floating-point number is the result of the operation

11   between the right endpoint of the first interval and the left endpoint of the second

12   interval; and

13   wherein the fourth floating-point number is the result of the operation

14   between the right endpoint of the first interval and the right endpoint of the second

15   interval.

1   35.   The apparatus of claim 33, wherein the computing mechanism is

2   configured to set the minimum to a value representing the empty interval, if any of

3   the at least four floating-point numbers contain the value representing the empty

4   interval.

1   36.   The apparatus of claim 25, wherein the value representing the

2   empty interval is a non-default NaN value.

1   37.   The apparatus of claim 34, wherein the computing mechanism is

2   configured to set the minimum to negative infinity if the first floating-point

3   number is a default NaN value and the fourth floating-point number is the default

4   NaN value.

1   38.   The apparatus of claim 34, wherein the computing mechanism is

2   configured to set the minimum to negative infinity if the second floating-point

3   number is a default NaN value and the third floating-point number is the default

4   NaN value.

1   39.   The apparatus of claim 33, wherein if none of the at least four

2   floating-point numbers is a default NaN value or a value representing the empty

3   interval, the computing mechanism is configured to select the minimum of the at

4   least four floating-point numbers.

1   40.   The apparatus of claim 34, wherein the operation can include one

2   of a multiplication operation and a division operation.

1   41.   An apparatus that performs a maximum computation for an

2   interval operation, comprising:

3   an input that is configured to receive at least four floating-point numbers,

4   including a first floating-point number, a second floating-point number, a third

5   floating-point number and a fourth floating-point number; and

6   a computing mechanism that is configured to compute a maximum of the

7   at least four floating-point numbers;

8   wherein if the at least four floating-point numbers include one or two

9   default NaN (not-a-number) values and the remaining values are not default NaN

10   values, the default NaN values are ignored in computing the maximum.

1   42.   The apparatus of claim 41,

2   wherein the maximum is a right endpoint of a resulting interval of the

3   interval operation;

4   wherein the first floating-point number is the result of an operation

5   between the left endpoint of a first interval and the left endpoint of a second

6   interval;

7   wherein the second floating-point number is the result of the operation

8   between the left endpoint of the first interval and the right endpoint of the second

9   interval;

10   wherein the third floating-point number is the result of the operation

11   between the right endpoint of the first interval and the left endpoint of the second

12   interval; and

13   wherein the fourth floating-point number is the result of the operation

14   between the right endpoint of the first interval and the right endpoint of the second

15   interval.

31

1   43.   The apparatus of claim 41, wherein the computing mechanism is

2   configured to set the maximum to a value representing the empty interval, if any

3   of the at least four floating-point numbers contain the value representing the

4   empty interval.

1   44.   The apparatus of claim 43, wherein the value representing the

2   empty interval is a non-default NaN value.

1   45.   The apparatus of claim 42, wherein the computing mechanism is

2   configured to set the maximum to positive infinity if the first floating-point

3   number is a default NaN value and the fourth floating-point number is the default

4   NaN value.

1   46.   The apparatus of claim 42, wherein the computing mechanism is

2   configured to set the maximum to positive infinity if the second floating-point

3   number is a default NaN value and the third floating-point number is the default

4   NaN value.

1   47.   The apparatus of claim 41, wherein if none of the at least four

2   floating-point numbers is a default NaN value or a value representing the empty

3   interval, the computing mechanism is configured to select the maximum of the at

4   least four floating-point numbers.

1   48.   The apparatus of claim 42, wherein the operation can include one

2   of a multiplication operation and a division operation.